

### Bird's Steering Methods.

MR. HEADLEY's suggestion (NATURE for July 27) that gulls sometimes steer by dropping one foot, is, it seems to me, hardly tenable, for so small a rudder acting on so thin a medium as air would be of little effect. And although I have seen many gulls under very varying circumstances, I have never seen them even appearing to direct their course in such a manner.

That birds, to a great extent, steer by changing the position of their centre of gravity is undoubtedly correct, and it is especially true of birds with long narrow wings, such as the petrels and sheerwaters. The albatross exhibits this method to perfection, and anyone who has watched this bird circling far and wide, will have noticed what an angle the outstretched, almost motionless, wings make with the level of the water, an angle frequently as great as 45°.

The flexion of the body is, I take it, of comparative little help, difference in force or direction of wing stroke being the main method by which birds direct their course.

The wings may act synchronously, a change in the direction of one wing causing it to act with more or less force than the other, while such change might be so slight as to elude the eye, or even a camera. A humming-bird will hover about a cluster of blossoms, now hanging motionless, now circling right or left around the flowers, and as there is no turn of the head or swaying of the body, it is evident that the directed force lies in the wings, although their presence is indicated by a mere hazy blur. The body is usually held at an angle of from 30° to 45° with the vertical, and the tail is kept closed, being indeed rarely spread, except when the bird is darting about in the air.

The use of wings is well shown by the crows, which in fall and winter roost in great numbers on the other side of the Potomac, and may be seen towards sunset winging their way homeward from their feeding places. When the wind is light, the crows fly high and steadily, but in windy weather they may be seen beating back, just skirting the tree-tops, apparently to take advantage of any favouring eddy that may exist near the earth. As the birds dart up and down, and from side to side, one can clearly see the wings open and close, and unless my eyes are very deceptive, the two wings are by no means always opened to the same extent.

The principal use of a bird's tail seems to be to effect vertical changes in direction, and while birds with moderately long tails usually have a more graceful, gliding flight than their abbreviated relatives, they are no more expert on the wing. The flight of the forked-tailed swallow is more pleasing than that of the short-tailed chimney swift, but the swift is quite as much at home in the air as is the swallow.

Birds with unusually long tails, such as the hornbills, are apt to be but indifferent flyers.

Washington, D.C., U.S.A., August 14. F. A. LUCAS.

### The Early Spring of 1893.

THE exceptional character of the spring of this year has already been described in these columns. It seems worth the while to inquire to what extent the warm weather commencing in March affected the times of flowering of our native flora. The Botanical Section of the Halifax Scientific Society has now for seven years, since 1887, kept a record of all plants observed by its members growing within the limits of the Halifax parish. This, it may be mentioned, is of considerable extent, perhaps measuring six miles by twelve or more. Thus, the record affords a means of comparing the dates of flowering this spring with those of previous years. Of course these will not coincide with records from other districts, as the South of England, but they will satisfy the necessary condition of such an inquiry, viz. that the district should be of limited extent so that the time of flowering of any species in one year is practically the same throughout it. In addition there is the advantage that the drought was not so great as to retard or kill the vegetation. On the other hand, such a record must necessarily be open to error; a plant may have been in bloom some time before it was met with; only a comparatively few species have been recorded every year without a break; some days often intervene between a flower being in bud and in bloom, and the record may possibly, without saying so, refer to the former. However, these errors are partly constant, and may be partly eliminated by neglecting the rarer species, which have only been noted two or three times.

In February almost the only plant to flower was the hazel, seen this year on the 15th, and last year fourteen days later.

In March twenty different species were observed in flower; of these only half had been previously recorded in March, the other half being equally divided between April and May. Coltsfoot (*Tussilago Farfara*) and *Salix Caprea* appeared at the usual time within the first week; the daisy was not noticed till the 31st, whereas it had previously been found on the 29th; but almost all the others were very much earlier than usual. The average was more than eighteen days before the earliest previous record. This is borne out by the fact that the same elm (*Ulmus montana*) was in flower this year (on March 9) twenty days earlier than last year. In some cases, e.g. *Stellaria Holostea*, *Ranunculus acris*, and *Alchemilla vulgaris*, the period was increased to as much as five weeks.

There were a few apparent exceptions, but they may certainly be put down to accident or rather neglect. The chickweeds, *Cerastium triviale* and *Stellaria media* escaped notice till April, groundsel had previously been noted earlier than April 9, and shepherd's purse was no doubt in flower early in April, but was ignored till May came in.

The effect of the weather became more pronounced throughout April. Excluding the common "weeds" just mentioned, every flower was at least a fortnight before its earliest previous record, and the list of twenty-five species is composed almost entirely of May flowers; in fact the only exceptions were the wood sorrel and the marsh marigold, in flower on the 5th and 8th, or antedated fourteen and twenty days respectively. On an average the flowers of April were 25.5 days earlier than in any of the previous years. The exact dates of a few of the commonest are appended.

|                              |                                   |
|------------------------------|-----------------------------------|
| <i>Cardamine pratensis</i>   | April 8, 1893; May 10-15, 1887-92 |
| <i>Scilla nutans</i> ... ..  | " 13, " " 1, 1887                 |
| <i>Lychnis diurna</i> ... .. | " 13, " " 10, "                   |
| <i>Veronica Chamaedrys</i>   | " 13, " " 15, 1888                |
| <i>Allium ursinum</i> ... .. | " 16, " " 5, "                    |

Thirty-five fresh species were added in May, twelve of which are usually June flowers. By this time, however, it became difficult to keep a complete record, so that about half a dozen appear to flower later this year than in one or other of the previous years. Again excluding these, the remainder flowered seventeen days earlier than before. From a consideration of those given below it would appear that the season was about three weeks earlier at the beginning of the month, and a fortnight at the end.

|                                    |                           |
|------------------------------------|---------------------------|
| <i>Cytisus Scoparius</i> ...       | May 6, 1893; May 13, 1890 |
| <i>Orchis mascula</i> ... ..       | " 6, " " 14, 1892         |
| <i>Geranium Robertianum</i> ... .. | " 6, " " 17, 1887         |
| <i>Trifolium pratense</i> ...      | " 6, " " 28, 1892         |
| <i>Quercus Robur</i> ... ..        | " 6, " " 29, 1887         |
| <i>Crataegus Oxyacantha</i>        | " 7, " " 29, 1888         |

(But usually June 3-9.)

|                                       |                        |
|---------------------------------------|------------------------|
| <i>Rhinanthus Crista-galli</i> ... .. | " 27, " " June 9, 1890 |
| <i>Chrysanthemum Leucanthemum</i> ... | " 27, " " 9, "         |

In June the advance still remained about a fortnight, taking twenty-seven species into consideration, but an increasing number have to be left out owing to the impossibility of recording all as soon as they appeared. Ten out of the twenty-seven had previously belonged to the catalogue of flowers appearing in July.

|                                     |                                    |
|-------------------------------------|------------------------------------|
| <i>Lychnis Flos cuculi</i> ...      | June 10, 1893; June 17-26, 1887-92 |
| <i>Silene Cucubalus</i> ... ..      | " 10, " " 26, 1888                 |
| <i>Rosa canina</i> ... ..           | " 10, " " 28, 1887                 |
| <i>Centaurea nigra</i> ... ..       | " 10, " " July 2, 1889             |
| <i>Lonicera Periclymenum</i> ... .. | " 15, " " 2, 1892                  |
| <i>Spiraea Ulmaria</i> ... ..       | " 15, " " 2, 1889                  |
| <i>Digitalis purpurea</i> ...       | " 15, " " June 24, 1890            |
| <i>Valeriana officinalis</i> ...    | " 17, " " 24, "                    |
| <i>Achillea millefolium</i> ...     | " 26, " " 27, 1892                 |

In July there seems to be no evidence for the maintenance of the advance; the flowers were then appearing at their normal season, e.g.—

|                                  |               |                    |  |  |  |
|----------------------------------|---------------|--------------------|--|--|--|
| <i>Campanula rotundi-</i>        |               |                    |  |  |  |
| <i>jolia</i> ... ..              | July 8, 1893; | July 2-15, 1887-92 |  |  |  |
| <i>Calluna Erica</i> ... ..      | " 22, "       | " 19, 1887         |  |  |  |
| <i>Fasione montana</i> ... ..    | " 1, "        | " 2, 1892          |  |  |  |
| <i>Cnicus arvensis</i> ... ..    | " 1, "        | " 2, 1889          |  |  |  |
| <i>Scabiosa succisa</i> ... ..   | " 22, "       | " 23, "            |  |  |  |
| <i>Galeopsis Tetrahit</i> ... .. | " 15, "       | " 16, 1892         |  |  |  |

The general result is, then, that the season was three weeks early in March, but that by the first of April the advance had increased to four weeks; this was maintained through most of the month, but May day was only some three weeks in advance; the fall continued slowly through May and June with an average advance of a fortnight. In July, however, the effects of the early spring had ceased to have any effect. These conclusions are more likely to err on the side of moderation, for it must be remembered that the flowering time this year has been contrasted not with the average, but with the earliest record of previous years.

W. B. CRUMP.

### Mr. Love's Treatise on Elasticity.

THE second volume of Mr. Love's treatise will doubtless be reviewed in NATURE in due course; but in the meantime I desire to make some observations upon certain criticisms, which this work contains, on my own papers on thin elastic shells, plates, and wires.

The theory of thin plates, and shells in the form given by Mr. Love, is based upon those of Kirchhoff, Saint-Venant and Clebsch. All these theories are incomplete and defective, and depend upon certain assumptions and approximations which have been called in question, and are by no means free from difficulty. An attempt has been made—see pp. 92 and 207—to remove these objections by classifying the different cases which arise, but whatever may be thought of the success of this explanation, it requires the reader to wade through a long and complicated analytical investigation before he is in a position to apply the theory.

On the other hand, the method of expansion originally employed by Poisson, and afterwards by myself, coupled with the hypothesis that the stresses  $R$ ,  $S$ ,  $T$  may be treated as zero, is one of great power, and, as I showed a few years ago, enables an approximate theory to be completely worked out as far as terms involving the cube of the thickness of the plate or shell, and Mr. Love is forced to admit on p. 236 that his own theory is incapable of doing this. It is true that Clebsch and Saint-Venant have raised objections against the method of expansion which I cannot regard otherwise than as frivolous ones; but although an account of the first class of theories is no doubt desirable, it is much to be regretted that Mr. Love has allowed his bias against the second class of theories to lead him to adopt a mode of treatment which greatly increases the difficulties of the subject, is less perfect, and which, I fear, will retard its further progress by throwing unnecessary obstacles in the way of students.

On pp. 238 and 262, Mr. Love imagines that he has detected an error in my own work as regards the values of  $T_1$ ,  $T_2$  (in his notation  $P_1$ ,  $P_2$ ), but this conclusion is not warranted. His investigation in § 353 expressly supposes the vibrations to be non-extensional, whereas in the investigation by which I have calculated,  $T_1$ ,  $T_2$  by means of the variational equation, extension is expressly supposed to take place. If it were desired to calculate the values of  $T_1$ ,  $T_2$  by the variational method in the case of inextensibility, it would be necessary to start with the corresponding form of the potential energy, and to take account of the fact that  $\delta u$ ,  $\delta v$ ,  $\delta w$  are not independent, either by means of indeterminate multipliers or by elimination. The two cases are therefore not parallel, and the so-called test is nugatory. If a direct test were desired, it could be supplied by means of the theory of the radial vibrations of a cylinder worked out to a second approximation.

The only other point to be noticed is that in the case of a bent wire the values of the three couples given by Mr. Love on p. 169 disagree with those obtained by myself. Mr. Love assumes these couples to be respectively proportional to the changes of curvature and twist, and he then proceeds to calculate the latter quantities in terms of the displacements by a method which leaves nothing to be desired as regards elegance and conciseness and comprehensiveness. But he can scarcely be said to have given anything which can be called a proof that these couples are actually proportional to the above-mentioned

quantities; and a new and independent investigation is much to be desired.

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Hotel de Russie, Bad-Ems, Nassau, Germany, August 23.

### An Appeal to Mathematicians.

SINCE I have commenced the study of the "Ramayana" (the great Sanskrit epic) in original Sanskrit, and its translations, epitomes, and commentaries by renowned European scholars, I have been struck with the inadequacy the western scholars of Indian chronology have shown in fixing the date of Rama.

I cannot but admire the method used by our modern Egyptologists in computing the dates of Egyptian chronology, and correcting the discoveries of some of the earlier researches in that interesting branch of knowledge. Having discovered it written in some old MSS. that in the reign of a certain king some remarkable comet or eclipse was observed, or a building was erected pointing to a certain star in the heavens, which has since changed position, &c., &c., our scholars have obtained sufficient data to compute with tolerable correctness a more or less trustworthy date for that king.

There is no doubt that such refined discoveries could never have been made if this branch of knowledge were left alone with simple historians or simple chronologists—I mean, no light would have been thrown over the pages of the dark history of Egypt had not astronomical methods been employed to solve the vital questions of Egyptian history.

I am very much grieved to see that the chronology of India has not at all been touched by any scientific investigator whose conclusions could be relied on, though Indian chronology is now proving to be far more interesting than the chronology of any other country or nation of the world. India has now the honour of being under the benign rule of the British nation, so forward in scientific matters; then does it not give grief to the lover of India to see this important branch of past history so much being neglected?

The second half of the eighteenth century and the first quarter of this nineteenth century had seen a few benefactors of India, like Profs. Colebrooke, Muir, Wilson, &c., whose discoveries brought to light much interesting information about ancient India. It was a misfortune for India of to-day that among those benefactors they were few who could bring in mathematical astronomy to solve some vital points of Indian chronology. Prof. Colebrooke wrote some valuable essays on the Hindu system of astronomy, but it was our misfortune that his attention was not drawn towards the Indian chronology; otherwise he was a man who could have done much to settle the dates of Hindu chronology.

Rama has been a personage of Indian history whose existence has not yet been denied by any scholar, yet see what conflicting dates have been given to this mighty king of ancient India: Sir William Jones places Rama in the year 2029 B.C., Tod in 1100 B.C., and Bentley in 950 B.C. Govvesio would place him about the thirteenth century before the Christian era!

Govvesio computes his date thus:—"From Rama to Sumitra, the contemporary, as it appears, of Vikramaditya (B.C. 57), fifty-six kings ruled in succession. By allowing on a reasonable computation an average of a little more than twenty years to each reign, we arrive at the thirteenth century before the Christian era." ("Ramayana," vol. i. Introduction.) While it is questionable whether any king by name of Sumitra ever reigned in India, or was a contemporary with Vikramaditya, Govvesio confesses—"But to this opinion I do not intend to attribute more weight than that of a probable conjecture." And so it is; and a ridiculous one, too; for Sumitra<sup>1</sup> was not a king contemporary with Vikramaditya, but she was one of the queens of the king Dasaratha, the father of Rama.

I now come to the point of my appeal. Here is the position of the seven primary planets at the birth of Rama plainly written in Canto xix. of the first book of the Ramayana: Moon in Cancer, Sun in Aries, Mercury in Taurus, Venus in Pisces, Mars in Capricornus, Jupiter in Cancer, and Saturn in Libra. The problem to be solved is this: Taking January 1, 1894, as starting-point, compute when the planets occupied the positions respectively referred to above, and when again they will occupy the same positions in the future? Though the problem appears to be a simple one of permutation and combination, but I must confess with regret that none

<sup>1</sup> "Sumitra" is a Sanskrit word of feminine gender. As Sanskrit was a living language at the time of Vikramaditya, though perhaps only within higher circles of society, yet it could not be believed that this word might have been so degenerated as to be used in opposite gender at that time.